MISSOURI DEPARTMENT OF CONSERVATION

Lost Valley Fish Hatchery

Biosecurity Plan

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This plan is intended for use at Lost Valley Hatchery with the main purpose of implementing biosecurity guidelines for the prevention of disease outbreaks and invasive species.

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Introduction

Lost Valley Hatchery (LVH) is located at Warsaw, Missouri between Lake of the Ozarks and Truman Reservoir. The hatchery grounds encompass 971 acres (Figure 1). It is the largest Missouri warm water hatchery and rears various sizes and species of warm and cool water fish. Annually, between 11.5 and 38 million eggs and fish are produced at LVH. Lost Valley primarily raises sport fish but also is involved with small scale production of mussels and threatened and endangered species. During previous years, bluegill, fathead minnows, channel catfish, golden shiner minnows, hybrid striped bass, hybrid sunfish, largemouth bass, muskellunge, paddlefish, Topeka shiners, walleye, black sandshell mussels, and snuffbox mussels have been grown on-site. The facility utilizes the following number of rearing units**:** (1) Seventy-eight rearing ponds, (2) Four concrete raceways, (3) Twenty-six fiberglass tanks, (4) Sixteen aluminum tanks, (5) Four - 10' circular tanks, (6) Four - 4' circular tanks, (7) Six - 6'circular tanks, (8) Two head boxes with total capabilities of 66 egg jars and 22 fry aquaria.

Water Supply

LVH has a complicated water supply system with wells, towers, ponds and pollution control structures (Figure 2). As a system, it is well protected except for its solar (ambient) pond, which is in a secure area, but is accessible to wildlife. Runoff water from the hatchery grounds cannot enter any of the rearing ponds. The water supply system, as described in the operating manual, is provided in detail below.

Well Water

1. Water to operate the hatchery is supplied by a combination of vertical turbine and submersible pumps in seven deep wells drilled on the area. The total expected yield of these seven production wells is 3,500 gpm (7.8 cfs).
2. All production wells are automatically controlled by the monitoring system and feed a common water supply pipeline which can discharge either to the cold water tower (CWT) at the hatchery building or the pond water tower (PWT). These towers contain aeration/degasification boxes and can handle up to 2,240 gpm (5 cfs). The CWT provides well water to the hatchery building, raceways, demonstration rearing pond, and the solar pond. The PWT provides water to the North, South, and East sets of rearing ponds.
3. The temperature of the well water is approximately 60°F. Aerated/Degassed well water from the water towers is designated WTE (water tower effluent) except in the hatchery building where it is designated CWS (cold water supply) (as opposed to HWS).

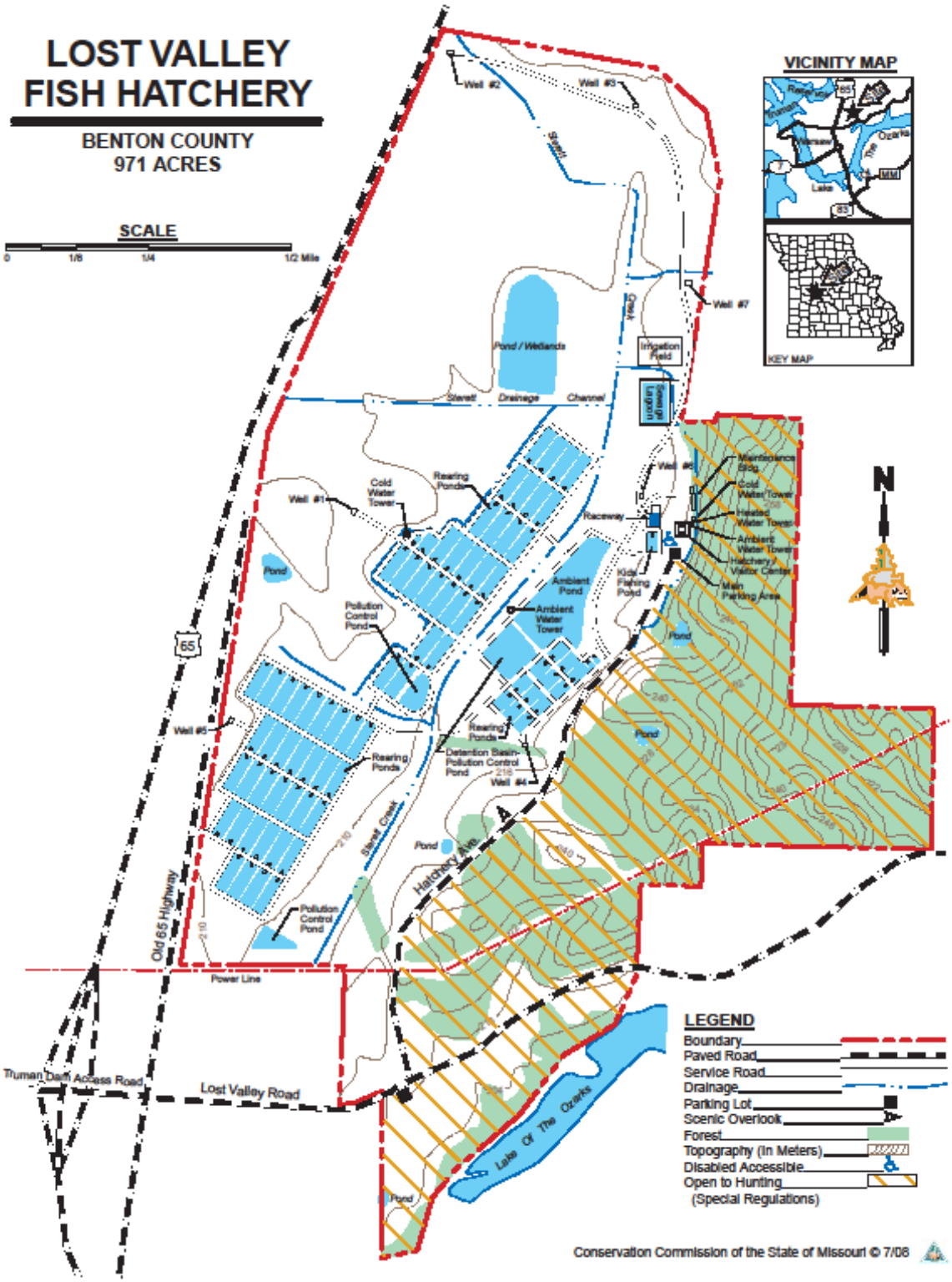

Figure 1. Area map of Lost Valley Hatchery.

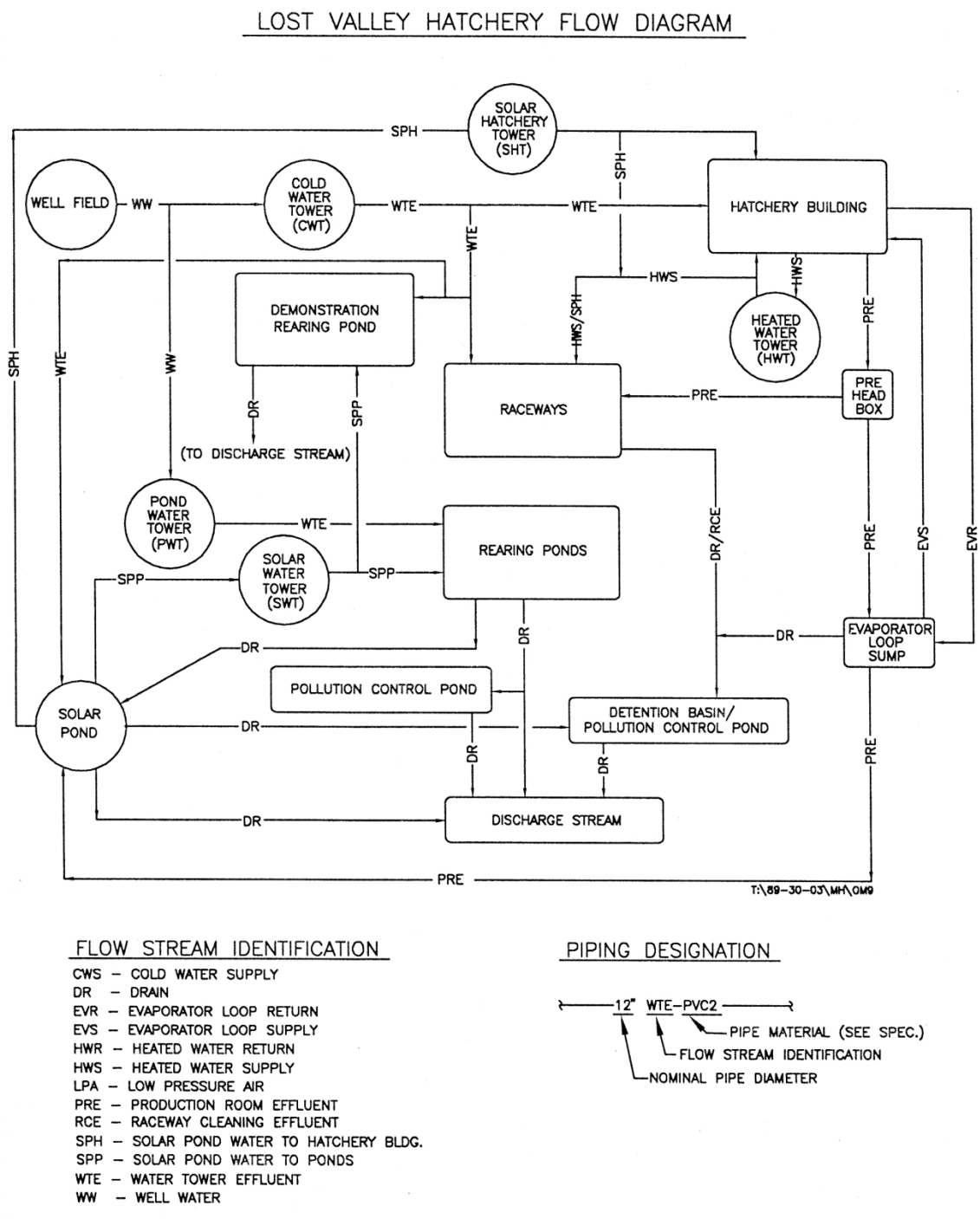

Figure 2. Lost Valley Hatchery water flow diagram

Heated Water Supply (HWS)

1. A maximum of 632 gpm (1.4 cfs) of water from the CWT can be run through an electric heat pump (HP-1) to raise the temperature from 60° to 80°F. This water is stored in the insulated heated water tower (HWT) and fed by gravity to the hatchery building or the raceways. A single line provides the raceways either HWS or solar pond water from the hatchery building (SPH). The heat source for HP-1 is the production room effluent (PRE), which is the water that has gone through the rearing units in the production room and has been drained out of the north side of the building to the PRE head box and the evaporator loop sump. At the evaporator loop sump, either of the evaporator loop pumps (EP-1 & EP-2) pumps a constant 632 gpm of the PRE water (now designed as evaporator loop supply (EVS)) to the evaporator side of HP-1. After passing through the heat pump, EVS becomes EVR (evaporator loop return). The temperature of the EVR is normally 15° to 18°F cooler than EVS. The temperature difference may be greater than this depending on the load on HP-1.
2. HP-1 can provide a minimum of approximately 60 gpm of 80°F water without cycling on and off.

HWT Bypass Valve (6" V210)

The heat pump (HP-1) requires a constant flow of 632 gpm.

Solar Pond (SPP & SPH)

1. The solar pond is a lined pond with a surface area of 10 acres and an average depth of 4 feet. The solar pond is designed primarily to heat 60°F well water to ambient rearing pond temperature for harvesting the rearing ponds (solar pond water to ponds=SPP). It can also be pumped to the hatchery building to be used in the production room or raceways (SPH).
2. At the solar pond inlet structure, the solar pond can be supplied with either aerated well water (WTE) or, if the hatchery manager determines the water quality is acceptable, production room effluent (PRE). There is an overflow weir at elevation 698.0, which keeps the solar pond from overtopping its levee. This overflow drains to Sterett Creek.
3. Water can be gravity drained from north rearing ponds to the solar pond water control structure if the water quality is acceptable. Solar pond water can be pumped to the solar water tower (SWT) which supplies aerated solar pond water to the rearing ponds (SPP) or pumped to the solar hatchery tower (SHT), which supplies aerated solar pond water to the hatchery building or the raceways (SPH). The solar pond can be drained to the detention basin/pollution control pond and Sterett Creek.

Production Room Effluent (PRE)

PRE is water that has gone through the rearing units in the production room and has been drained out of the north side of the building to the PRE headbox. This headbox is located to gravity feed the future secondary production facility. In the first chamber of the PRE headbox, a 12" pipe feeds the raceways. Water not diverted to the raceways flows over a weir into a second chamber that pipes water to the evaporator loop sump. Here the water can be pumped to HP-1. Excess water spills over a weir where the water can be directed to the detention basin/pollution control pond (RCE) if the gate is opened or overflow to the solar pond inlet structure (PRE) if the gate on the RCE line is closed.

Water Towers

Cold Water Tower (CWT)

1. Receives new well water and supplies the hatchery building, raceways and demonstration rearing pond.
2. Has five aeration/degasification boxes inside tower for a 2240 gpm (5 cfs) maximum flow rate.
3. The 32' – 8"Ø x 40' tall tank has a 30' water depth (6,270 gallons/foot of depth).
4. A 8' tall stand pipe reserves the bottom 8' (50,000 gallons) for fire protection.
5. Contains 138,000 gallons of storage capacity for hatchery building. This is 1.6 hours of storage at the design flow rate of 1,440 gpm (3.2 cfs) and 1 hour of storage at the maximum flow rate of 2,240 gpm (5 cfs).
6. The CWT circulating pump housed in the generator and fire pump house provides freeze protection by circulating the tower's contents at a rate of 100 gpm.

Pond Water Tower (PWT)

1. Receives raw well water and supplies the North, East, and South sets of rearing ponds.
2. Has five aeration/degasification boxes inside tower for 2,240 gpm (5 cfs) maximum flow rate.
3. The 32' – 8"Ø x 40' tall tank has a 30' water depth (6,270 gal/ft.).
4. Contains 188,000 gallons of storage capacity, which is 1.4 hours of storage at the maximum flow rate of 5 cfs.
5. The PWT circulating pump housed in blower/well house No. 1 provides freeze protection by circulating the tower's contents at a rate of 100 gpm.

Heated Water Tower (HWT)

1. Received heated (80°F) water from heat pump HP-1 and supplies the hatchery building and raceways.
2. Has two aeration/degasification boxes inside tower for a 900 gpm (2 cfs) maximum flow rate.
3. The 18' – 6"Ø x 44' tall tank has a 34' water depth (2,000 gal/ft. depth)
4. Contains 68,000 gallons of storage capacity, which is 1.8 hours of storage at the maximum design flow rate of 632 gpm (1.4 cfs).
5. The tank is insulated to approximately R-18.

Solar Hatchery Tower (SHT)

1. Receives water from the solar pond (via pumps SPPH-1 & SPPH-2) and supplies the hatchery building and raceways.
2. Has two aeration/degasification boxes inside tower for a 900 gpm (2 cfs) maximum flow rate.
3. The 18' – 6"Ø x 44' tall tank has a 34' water depth (2,000 gal/ft. depth).
4. Contains 68,000 gallons of storage capacity, which is 1.25 hours of storage at the maximum design flow rate of 900 gpm (2 cfs).

Solar Water Tower (SWT)

1. Receives water from the solar pond (via pumps SPPP-1 & SPPP-2) and supplies the North, East, & South rearing ponds.

2. Has two aeration/degasification boxes inside tower for a 900 gpm (2 cfs) maximum flow rate.
3. The 18' – 6"Ø x 44' tall tank has a 34' water depth (2,000 gal/ft. depth).
4. Contains 68,000 gallons of storage capacity, which is 1.25 hours of storage at the maximum design flow rate of 900 gpm (2 cfs).

Hatchery Building

Production Mechanical Room

1. SPH – The SPH line comes from the solar pond via pumps SPHS-1 and SPHS-2 at the solar pond water control structure. Each SPHP pump is designed to deliver 450 gpm (1 cfs) and one or both pumps may be operated simultaneously.

    a. There is a drain valve in the Production Mechanical Room that will allow the SPH line to be purged before putting it on line
    b. The SPH water should normally be run through the filters F-1, F-2, and F-3 for particulate removal. The filters are sized for a 450-gpm flow rate*.
    c. After being filtered, SPH water goes through the ultraviolet water disinfection units UV-1 and UV-2. Each UV unit is designed for flows of 720 gpm. One unit per SPHP pump is used for best disinfection although one UV unit can handle both pumps if the water quality is high.
    d. UV-2 can be isolated from the SPH line and CWS water can be run through it, if desired.
    e. After disinfection, SPH water goes to the aeration boxes in the top of the solar hatchery tower (SHT) from which it is gravity fed to the production area and the raceways.

    *Currently only the UV units are used. The sand filter units are currently isolated and not used due to the organic matter in the solar pond. The renovation of the pond is scheduled FY11 and once it is complete, the solar water will be sent through the sand filters.

2. WTE/CWS – Water tower effluent (WTE) is called cold water supply (CWS) inside the hatchery building. In the production mechanical room CWS is pumped by either CP-1 or CP-2 at a rate of 632 gpm through HP-1 and into the HWT.
3. WP-1 – The production area CWS washdown pump (WP-1) provides 15 gpm of pressurized, untreated well water (CWS) to wash the production area and rearing units.
4. RB-1 & RB-2 – Low-pressure air (LPA) blowers RB-1 and RB-2 each can provide 15 CFM of oil-less air to all rearing units in the production room.

Production Area

The main indoor production area has 26 fiberglass tanks, 16 aluminum tanks, four- 10' circular tanks, two- 4' circular tanks, six-6'circular tanks, two head boxes with total capabilities of 66 egg jars and 22 fry aquaria (Figure 3).

Figure 3. Bank of aluminum tanks in production room.

1. Each rearing unit in the production area is supplied with CWS, HWS, SPH, and LPA. All but SPH are in pipe trenches. SPH is overhead.
2. The pipe trenches are sloped to the north and a drain pipe carries washdown water to the sewage lagoon.
3. The trench drains collect water from the rearing units (PRE) which goes to the PRE Head box described earlier.

Rearing Ponds

General

1. The rearing ponds are primarily 1-acre and ½-acre lined ponds with a 6" supply pipe at the upper end for filling and flow-through supply and harvesting kettle at the lower end. There are also three 0.1-acre special use ponds. The ponds are identified as North (N1-N30), South (S1-S33) and East (E1-E14) (Figure 5).

2. All ponds are three feet deep at the upper (inlet) end and slope to six feet deep at the lower (kettle) end. The 1-acre ponds have a normal pool volume of 3.6-acre feet (156,816 cubic feet or 1,173,000 gallons). The ½-acre ponds have a volume of 1.8 acre-feet (Figure 4).

Figure 4. Empty 0.5 acre rearing pond.

3. The kettles have a fixed weir, which will maintain a 6' water depth at the lower end of the pond. A gate in the weir wall will allow complete drainage of the pond. Each kettle has both WTE and SPP available to use when harvesting the pond. The SPP will normally be used, as this is the same temperature as the pond water. LPA is also available at each kettle for aeration.

4. The pond drain lines are sized to drain four adjacent 1-acre ponds in eight hours (this is a flow rate of 9,775 gpm (21.8 cfs)).

North Pond Water Reuse

1. The water in North ponds N1 through N24 can be gravity drained to the solar pond. Water can be drained directly to Sterett Creek, be diverted to the North pollution control pond (if a high solids load is present), or be routed to the solar pond (if the water quality is acceptable).
2. Manhole N3 has an overflow weir at elevation 700.0. This weir allows water to flow directly to Sterett Creek if all the gates in manhole N3 are closed. This structure also has two 6' pipes which drain into it. These are purge lines for the SPH & WTE lines.
3. The solar pond has a normal pool elevation of 698.0 with a bottom elevation of 694.0. The normal pool elevation for ponds N1 through N24 varies from 709.5 to 701.5. The bottom of pond elevations vary from 703.5 to 694.5.

North Pollution Control Pond

1. Manhole N4
   a. All North ponds can be gravity drained to manhole N4. From this structure, the water above elevation 689.50 can be diverted to Sterett Creek or water above elevation 688.50 can be gravity drained to the North pollution control pond. The North pollution control pond has a normal pool elevation of 691.5.
   b. When the water level in the pollution control pond is too high to be gravity fed, pumps are used to drain the rearing ponds into the pollution control pond. Each pump is capable of moving 1500 gpm (3.3 cfs).
   c. The pumps are controlled by float switches for automatic operation.
   d. An overflow weir at elevation 693.0 spills water to Sterett Creek and keeps water from backing up into the North rearing ponds.

2. The pollution control pond is drained through the North pollution control pond outlet structure. All pipe inverts are at elevation 687.5, which is the same as the bottom of the pollution control pond. An overflow weir can be adjusted to maintain the pond level from elevation 691.5 (normal pool elevation) to 696.0. A gate at invert elevation 687.5 may be opened to drain the pollution control pond to Sterett Creek.

South Pollution Control Pond

1. <u>Manhole S4</u>
   a. All South ponds can be gravity drained to manhole S4. From this structure, the water above elevation 682.50 can be diverted to Sterett Creek or water above elevation 679.50 can be gravity drained to the South pollution control pond. The South pollution control pond has a normal pool elevation of 683.0.
   b. When the water level in the South pollution control pond is too high to be gravity fed, pumps are used to drain the rearing ponds into the pollution control pond. Each pump is capable of moving 1500 gpm (3.3 cfs).

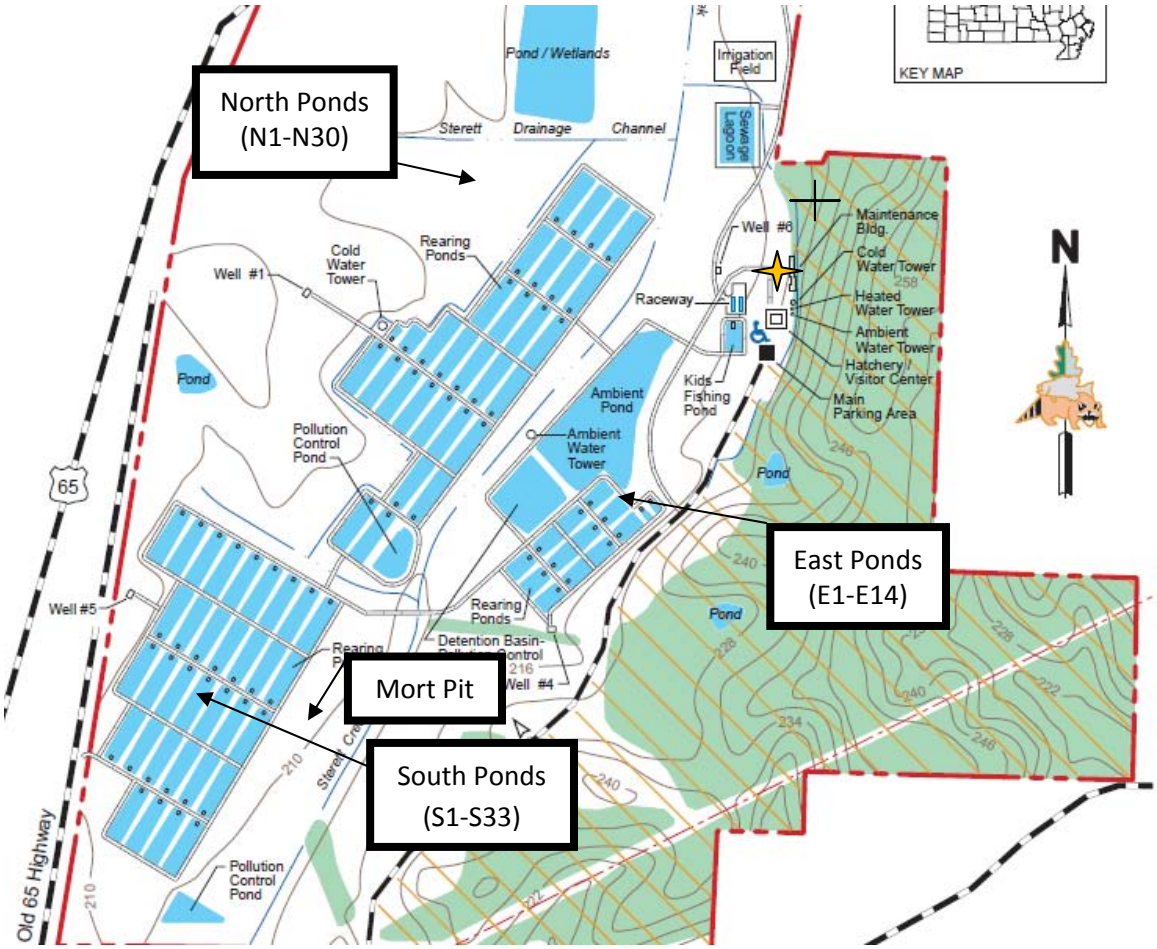

Figure 5. North, South, and East rearing ponds and equipment cleaning area (✦).

c. The pumps are controlled by float switches for automatic operation.
d. An overflow weir at elevation 686.0 spills water to Sterett Creek and keeps water from backing up into the South rearing ponds.

2. The pollution control pond is drained through the South pollution control ponds outlet structure. All pipe inverts are at elevation 679.0, which is the same as the bottom of the pollution control pond. An overflow weir can be adjusted to maintain the pond level from elevation 683.0 (normal pool elevation) to 690.0. A gate at invert elevation 679.0 may be opened to drain the pollution control pond to Sterett Creek.

East Rearing Ponds

1. All East rearing ponds can only be drained through the detention basin outlet structure. The bottom of the lowest kettle elevation in the East ponds is 689.0, therefore all ponds can be gravity drained to the detention basin/pollution control pond whose normal pool elevation is 694.0.

2. The East ponds can be drained to Sterett Creek by closing both canal gates on the structure and allowing the water to go over the 695.0 weir wall to the drain.
3. Water can be sent to the pollution control pond by opening the 690.5 gate and closing the other gate.
4. A weir at elevation 694.0 keeps the level in the pollution control pond from rising too high.

Pond Aeration

1. Two connections for aeration (LPA) are provided at each kettle.
2. Each set of rearing ponds (N, S, & E) have a blower building that houses two blowers. The blowers for the North and South ponds will aerate ½ of the ponds simultaneously. The blowers for the East ponds can aerate all ponds simultaneously.
3. The specified diffusers are designed to operate at 20 cubic feet per minute (cfm). The ½-acre ponds are designed to operate with one diffuser (20 cfm) and the 1-acre ponds are designed to operate with two diffusers (40 cfm total).

Purpose of Plan

Historically, the major threats concerning Lost Valley Hatchery have been parasitic protozoan and bacterial infections (i.e. *Aeromonas* and *Columnaris)*. The levels of intensity are indicative to specific times of the year. This plan will provide guidelines for the reduction of spreading further outbreaks from infected lots. It will also provide measures for the transfer of fish and eggs from and to Lost Valley Hatchery.

There will be an acceptable risk associated with this plan. This plan is a set of guidelines that will be followed when possible. Due to the nature of fish culture at this facility, the specific guidelines in this plan may not always be applicable to MDC programs or species being propagated. Implementation of this plan to its fullest will be assessed on a case-by-case basis. Limitations on the plan will include budget constraints and the hatchery's complex layout. Another limitation to the overall effectiveness of the plan will be the recent reduction in staff present at the hatchery and the time involved with some processes.

Greatest concerns of Biosecurity

1. Statewide pathology lab is located within the hatchery production building. Diseased fish from outside sources are routinely brought into the lab for analysis which poses a dangerous risk of contamination to the hatchery.
2. Introduction of commercially raised fish routinely transported on-site (i.e. channel catfish and forage fish).
3. Importation of fish from public waters and state hatcheries having "unprotected" surface water supplies.

4. Location of hatchery building less than two miles from Lake of the Ozarks confirmed with zebra mussel populations.
5. Great blue heron rookery located within two miles of hatchery facility.

Fish Transfers

Background

Figure 6. Loading fish on truck for stocking.

As indicated in the Introduction, Lost Valley Hatchery routinely cultivates musky, walleye, and hybrid striped bass. Either wild Missouri broodstock, as in the case of walleye, are brought on-site for spawning or eggs; or fry or fingerling are received from a non-Missouri source. The adult walleye are not screened for any pathogens prior to being brought on-site. They are housed inside of the production building in fiberglass tanks during March. Musky typically originate in Iowa and hybrid striped bass originate in Arkansas and Oklahoma. At present, musky fingerlings are tested for VHS prior to being shipped to Lost Valley Hatchery. Arkansas VHS tests broodstock (using milt and egg samples) used in the production of hybrid striped bass. In addition, a recent VHS statewide survey of Arkansas indicated the state was negative for VHS.

Lost Valley also maintains two ponds of display fish used for the Missouri State Fair. These fish are collected from bodies of water from around the state and held year-round for display purposes.

Because the MDC fish pathology lab is also located in the LVH production/office building, diseased fish are received on-site in the lab. This process brings an associated risk of pathogen transfer to LVH including those not already documented on-site. Diseased fish and samples from state hatcheries, private commercial hatcheries, and wild stock are routinely brought into the lab. These fish/samples have the potential to carry various pathogens that could infect hatchery propagated fish. This could potentially spread pathogens statewide, unknowingly, if contaminated production fish are transported before signs of infections are detected.

Lost Valley also serves as a transfer point for channel catfish to be stocked in the Kansas City and St. Louis urban areas (Figure 6). These fish are currently purchased from private Missouri fish hatcheries, brought to Lost Valley and held in the outdoor raceways for one to three days before being transported to their final destination.

Other species, such as largemouth bass and channel catfish are transferred to LVH, primarily from Chesapeake Hatchery within the MDC system. LVH will also transfer some fingerling channel catfish to

Lake Paho for grow-out. All fish transfers between MDC facilities, non-MDC facilities, and within LVH have potential to transfer pathogens or aquatic nuisance species.

Highest Risks

1. Aquatic nuisance species and pathogens (parasitic, bacterial, viral)
    a. Statewide Pathology lab
    b. Non-MDC hatcheries
    c. Between MDC hatcheries
    d. Wild fish

Statewide pathology lab

1. No fish, samples, equipment, or personnel shall be transported from the pathology lab into the hatchery production room.
2. The doorway leading from the pathology lab to the hatchery production room shall **only** be used as an emergency exit. Biosecurity protocol concerning the statewide pathology lab shall be covered in its separate biosecurity plan (Appendix E).

Transfers from non-MDC hatcheries

1. Before a shipment of fish shall be received from a non-MDC fish hatchery, hatchery staff shall consult with their supervisor and the Aquatic Animal Health Specialist to determine the most appropriate health test required for the species to be imported. The shipper shall submit current fish health inspection records to the Aquatic Fish Health Specialist for review and issuance of an import permit (if necessary). The required tests will be reviewed on a case-by-case basis and will take into account the life history of the species being transported.
2. Ideally, the receiving hatchery manager shall ask the shipping hatchery manager to complete and fax or email back to him a *Fish Transfer Information Sheet* along with mortality records for the previous 15 days (Appendix A). This sheet will help us identify in writing any other pathogens/nuisance species not specified on the health inspection record which may occur in their watershed or hatchery. This would include other viruses, parasites, zebra mussels, New Zealand mud snails, Quagga mussels, rusty crayfish, or parasitic copepods.
3. The fish will be treated with the proper zebra mussel treatment according to MDC policy (Appendix B).
4. All equipment used during the off-loading of these fish shall be disinfected after use.
5. Wild-caught walleye from Lake of the Ozarks will be collected and transported per the Broodstock Collection HACCP (Appendix D). These walleye are held indoors in fiberglass tanks for spawning in March; water discharging from the production building during this time period will be diverted to Sterett Creek for discharge rather than to the ambient pond, if the water is not needed for recycling purposes. This procedure will help minimize contamination of the ambient pond.
6. Fish being held for transfer (e.g. channel catfish for urban fishing program) or fish with unknown health status (wild fish) will be held in the outdoor raceways, if possible. These units

will serve as isolation units since water leaving these raceways goes to the pollution control pond and discharges directly to the stream. During use, water shall not go to the solar (ambient) pond, unless water reuse is necessary.

Transfer of fish between MDC hatcheries

1. Ideally, three days prior to the transfer of fish between MDC hatcheries, the shipping facility shall fax or email the receiving hatchery manager a copy of this unit's mortality record which shall cover the previous 15 days. In addition, comments shall be made regarding the lot's general history, past chemical therapies, and notes of any abnormal behaviors observed by completing a *Fish Transfer Information Sheet* (Appendix A).
2. Visibly abnormal fish shall be culled prior to shipment.
3. During transport fish shall be treated for Zebra Mussels per MDC policy (Appendix B):

   750 ppm KCL for 1 hour, then 25 ppm formalin is added for an additional 2 hours. Total treatment time is 3 hours.

4. When applicable, fish will be isolated at least three weeks before they are co-mingled with other resident fish.
5. Relief of post-transportation stress in the fish may be reduced by providing 0.5% salt for one to three days after arrival.
6. Rubber boots and raingear worn during delivery of fish shall be disinfected by acceptable methods.
7. The transport truck shall be power washed and disinfected either en route back to the hatchery of origin or at the designated hatchery cleaning site. It shall not be used for any new lots of fish unless it is disinfected.

General Equipment Use and Cleaning

Background

A variety of equipment is used at Lost Valley Hatchery. Equipment and human hands are recognized as modes for pathogen transfer. Viruses, bacteria, and parasites are invisible to the naked eye so their transmission via objects is easily unnoticed. Examples of common equipment items are listed below.

1. **Personal protective equipment**: e.g. waders, hip boots, rubber boots, raingear, gloves.
2. **Work equipment**: e.g. dip nets, buckets, brooms, brushes, aerators, weighing scales.
3. **Vehicle equipment**: e.g. fish trucks, utility vehicles, pick-up trucks, and area fish transport tanks.

Highest Risks:

1. Pathogens: bacterial, viral, parasitic
2. Aquatic nuisance species

General Guidelines

1. **The sharing of personal protective and work equipment between fish hatcheries is discouraged**. Guest workers at LVH should be provided personal protective equipment to use during their visit. This equipment shall be maintained at this site. If on the rare occasion that there is not enough equipment available for guests and they must bring their own, these items should be thoroughly disinfected as needed.
2. The front of the shop building is where equipment and protective clothing will be cleaned or disinfected (Figure 5).
3. During cleaning the layers of fish slime, mud, or organic debris will be first removed by appropriate methods and then be disinfected by an acceptable method.
4. If sponges or cloth towels are used, they shall be cleaned by running them through a wash cycle with laundry detergent and dried by running through a cycle in the clothes dryer
5. Equipment items will be stored at location of use, if possible. For example, buckets and nets used in a hatching area should be stored in that area and only be used in that area. As well, outside equipment should be stored in the two bay storage areas and only be used outside.

Vehicle Disinfection

1. If fish transport trucks are sent off-site to deliver or move fish, they will be washed and disinfected either en route back to the hatchery or at the designated cleaning site located outside the shop doors. All vehicles shall be properly disinfected as needed.
2. Vehicles and buckets or tubs used to transport dead fish to the mort pit area shall be cleaned and disinfected.

Treating Sick Fish

Background

At LVH the primary stressor inducing disease outbreaks in rearing ponds is poor water quality levels which primarily occur during the summer months. When disease outbreaks occur in a rearing unit, the risk of spreading this pathogen to other rearing units increases. Our goal is to isolate this sick unit as much as possible.

Highest Risk

1. Spreading pathogen to other rearing units on-site

General Guidelines

1. The cause of the increased mortality shall be identified through necropsy, skin scrape, gill biopsy, clinical signs, bacterial or viral culture. It shall then be treated appropriately.
2. Units of sick fish will be considered as quarantine areas. Fish should not be moved, inventoried or split (unless thinning is used as part of the treatment) and specific equipment shall be dedicated for their use only. The mortalities for this area will be picked up last. The equipment will be disinfected daily and only be used for that area.
3. All equipment coming in contact with these fish and unit shall be immediately disinfected.
4. The fish shall not be moved/ transported off-site unless it is determined that this is necessary for their therapy. If moved to another hatchery, a fish transfer sheet will be sent to the receiving hatchery electronically at least three days prior to shipment (Appendix A).
5. After any contact with these fish or water (e.g. picking up mortalities, brushing raceway), staff shall wash hands with soap and water or use a hand sanitizer. Equipment and waders should also be properly disinfected.

General Sanitation

Background

The maintenance of a high standard of general sanitation is a proven method for minimizing disease outbreaks in both humans and animals. At Lost Valley Hatchery, the following areas are identified for general sanitation:

1. Handling of fish mortalities from rearing units
2. Cleaning of rearing units between lots
3. Cleaning of counters and floors in production room.

Highest risks

1. Bacterial pathogens in dead fish are at peak levels; therefore, their handling can be considered a serious mode of disease transmission.
2. Parasites and bacterial pathogens may be transmitted in water and/or fish waste products.
3. Bacterial and viral pathogens may contaminate hands, floors, and equipment in the laboratory or the production room.

Fish Mortality Sanitation

1. Specific equipment, such as nets, buckets and vehicles, shall be designated for picking up dead fish. Buckets and nets used for this activity should be prominently labeled and/or colored and not be used for any other activity.
2. Mortalities will be removed daily from rearing units. Tanks or raceways with noticeably sick fish will have the mortalities removed last. Specific equipment will be used for these units only.
3. Mortalities from ponds will be taken to the mort pit area for disposal. The pit will be located away from any rearing ponds, to prevent drainage into the ponds. This will also minimize transfers of dead fish by wildlife (Figure 5).
4. Personnel shall wash their hands with soap and water or use hand sanitizer after collecting and disposing of dead fish. Hand sanitizers shall be conveniently placed in the production building, lab, and employee bathrooms.
5. The vehicle used to transport the dead fish shall be hosed out at the designated equipment cleaning area after each use and disinfected. Daily cleaning will be warranted if mortalities are high and multiple uses are needed each day.

Cleaning Rearing Units

1. Between lots of fish, rearing units shall be dewatered completely when possible.
2. Outdoor raceways units are to be left to dry for as long as possible. If any disease issues are noticed with a lot of fish, the raceway shall be disinfected.
3. Indoor tanks will be scrubbed with a brush/pad, and if needed sprayed with Sani-Foam and disinfected.

Fish Lab

1. Floors will be routinely cleaned and disinfected.
2. Mortality buckets will be disinfected.

Production Room

1. Areas to hatch eggs and rear fry shall be kept clean.
2. All equipment used for eggs and fry shall be designated for this area only.
3. When possible, each tank or set of tanks shall have its own net and brush. If nets or brushes are shared, they shall be appropriately disinfected between uses.
4. Floors shall be power washed or hosed down as needed.

Vaccinations

Vaccinations are not currently done at Lost Valley Hatchery. If vaccinations become necessary in the future, the plan will be amended to include protocol.

Broodstock management

Background

LVH annually receives approximately 400 wild caught walleye from Lake of the Ozarks for spawning purposes. These fish are temporarily housed in fiberglass tanks in the production building during March. After the fish are spawned, they are returned to Lake of the Ozarks. LVH also maintains and periodically receives adult wild fish for display purposes. Other species of broodstock kept on-site are bluegill, Topeka shiners, orangespotted sunfish, fathead minnows and golden shiner minnows. They typically are spawned extensively in ponds. None of these captive broodstock have been tested for viruses. Adult mussels are brought on-site for juvenile propagation; however, they are not placed into rearing units. Mussel propagation may also necessitate maintenance of wild caught logperch on-site.

Highest Risks

1. Viral pathogens (VHS, LMBV, Spring Viremia of carp, CCFV)
2. Bacterial pathogens (*Columnaris*, *Aeromonas*)
3. Aquatic nuisance species

General Guidelines

1. At the time of spawning staff will select only apparently healthy fish for spawning. In particular, fish with poor body condition, ulcerated skin, hemorrhagic skin, darkened skin, exophthalmia, a hemorrhagic vent, or very pale gills shall be culled from the breeding population with no gametes taken.
2. When applicable, eggs will be disinfected with 100 ppm iodine (Argentyne or Ovadine®) for 10 minutes soon after fertilization or after 2 hours of water hardening, depending on the fish species and available information, to decrease the likelihood of pathogen transfer from infected and non-clinical carrier fish. Well water will be utilized during the hardening process for further prevention of pathogens. Water pH will be maintained between 7.0 and 7.5 for optimal effectiveness. Evaluation of survival of iodine treated eggs will need to be completed before full-scale treatment is implemented.
3. Adult mussels will be treated according to the *Mussel Broodstock Collection HACCAP* described in Appendix C.
4. Wild-caught broodstock walleye will be handled according to the *Broodstock Collection HACCP* described in Appendix D.

Public Use

Background

Each year, approximately 30,000 people visit Lost Valley Hatchery (Figure 8). They come from all over the world. Currently, the public is welcome to freely explore areas around our rearing pools, Conservation Area and Kids Fishing Pond. Guided tours are provided inside the production room. MDC encourages educational interaction with the public at all fish hatcheries. In addition to humans, the hatchery will also have wildlife visitors. Wildlife frequenting facilities include Great Blue Herons, Bald Eagles, skunks, raccoons, muskrats, possums, minks, otters, vultures, ospreys, hawks, and various waterfowl. Wildlife not only preys upon fish but can also transfer diseased fish from one area to another and regurgitate partially eaten food. They are recognized as biological vectors of disease.

Figure 8. Fishing Day event. LVH Kid's Fishing Pond during June Kid's Fishing Day

Highest Risks

1. Humans: although the risk is ranked as low, shoes and hands of visitors may transfer undesirable pathogens, parasites, or aquatic nuisance species onto the facility (muddy shoes) or between rearing units (if hands are put in the water or bait buckets are emptied).
2. Wildlife: Mechanical transfer of diseased fish or aquatic nuisance species.

General Guidelines - Humans

1. Public traffic around outdoor rearing areas is unavoidable.
2. Only guided tours will be allowed inside the hatchery building. A viewing area for the public is provided through the Visitor Center for walk-in visitors. Special displays will be set up in the production room and visitor center as appropriate (i.e. hatching jars, posters displaying production activities). A video of hatchery operations is also available for public viewing at the Visitor Center.
3. Currently, anglers to the Kid's Fishing Pond are asked not to use any baits which have been transported or held in containers of water. Anglers are provided free hot dogs and worms on-site to use in the fishing pond. Specific regulations prohibiting bait buckets and bait needing water will be submitted to the Code Review Committee.

General Guidelines - Wildlife

The following steps may be undertaken to discourage nuisance wildlife residence at MDC hatcheries.

1. Dead fish will be removed from rearing units on a daily basis.
2. The practice of feeding dead fish to wildlife will be eliminated.
3. Feed storage areas will be kept clean (mold and moisture free).

General Disease Surveillance

Background

Implementation of a surveillance program will provide a means of detecting the presence of aquatic nuisance species and pathogens for early intervention and help provide bench marks for eradication measures. Due to the proximity of a zebra mussel positive waterbody (Lake of the Ozarks), LVH is at a higher risk for infection with zebra mussels when compared to other MDC warm water hatcheries. Having records of periodic assessments of fish health on-site will also prove valuable during the trading of MDC fish to other states.

Highest risks

1. Viral pathogens
2. Parasitic protozoan
3. Bacteria
4. Aquatic nuisance species: zebra mussel, New Zealand mud snails, Quagga mussels, etc.

General Guidelines

1. Good staff education is the number one preventive measure for disease surveillance. Education will provide a means for staff to recognize problems and take steps to correct them.
    a. Require that each staff member take the Basic Fish Health class provided by MDC.
2. Artificial substrates consisting of layers of discarded plastic signs for detecting zebra mussels will be placed in the ambient solar pond at the north drain structure, off the south bridge across Sterett Creek and in the south pollution control pond for visual monitoring every 60 days (Figures 9 and 10).
3. The MDC Aquatic Animal Health Specialist will conduct annual testing for viruses and will take additional samples as needed for shipments to other states.
4. Fish displaying abnormal behaviors (going off feed, changes to skin color, reddened fins, increased mortalities, etc.) will be promptly evaluated (at a minimum, by general external appearance, skin scrape and gill biopsy) on-site and treated appropriately. If initial therapy is

unsuccessful or if additional tests are needed which are not available (e.g. bacterial culture, histopathology) they will be referred to the MDC Aquatic Animal Health Specialist for further evaluation.

5. Mortality records in writing will be maintained on a daily basis for each rearing unit. These records will be sent to other fish hatcheries during fish transfers and will provide a means of monitoring fish health.

Figure 9. Artificial sampler covered with zebra mussels 7 months after placement in Lake of the Ozarks (from Brian McKeage, MDC).

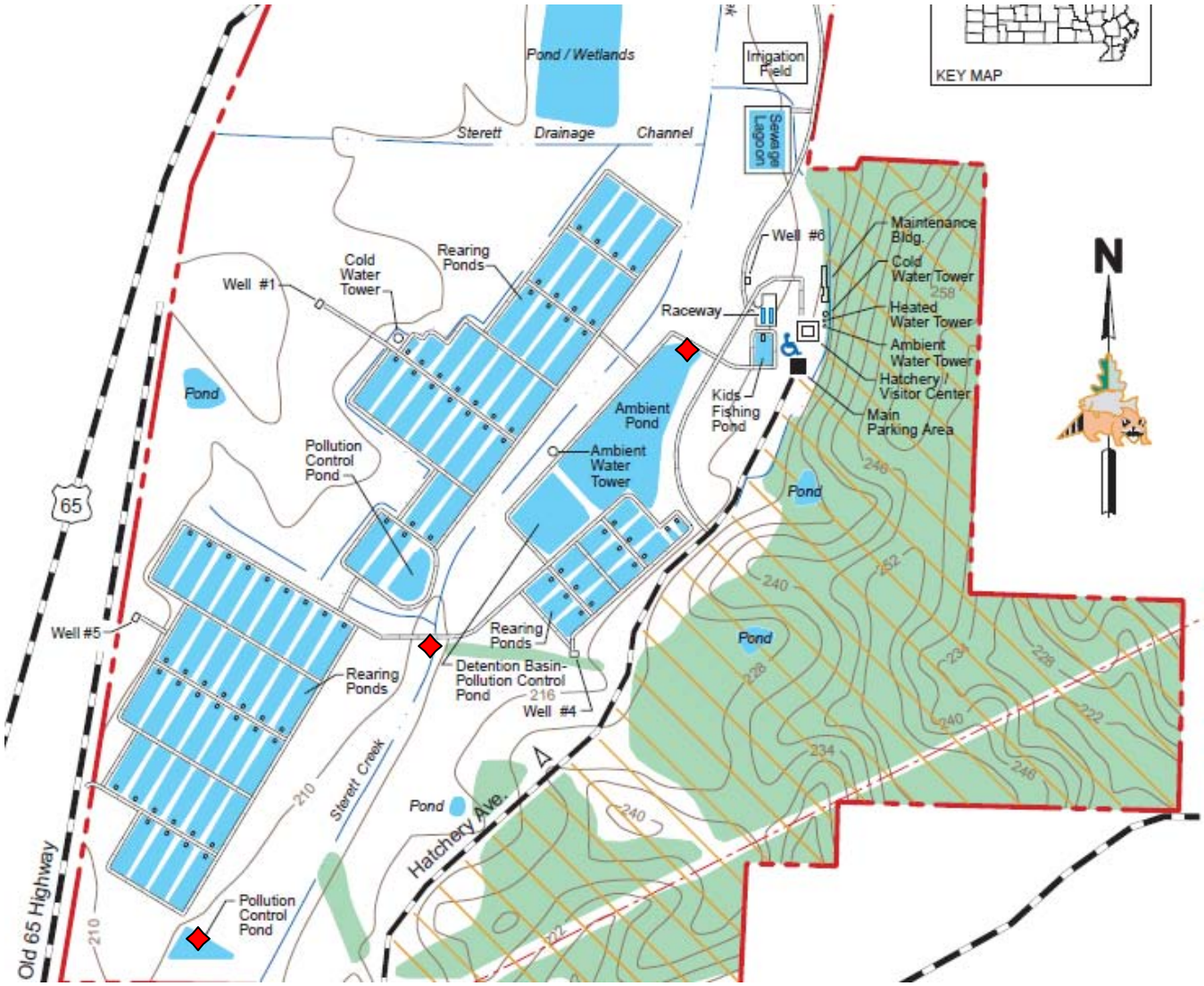

Figure 10. Zebra mussel monitoring sites (◆).

Budget Considerations

Equipment

The initial expense of the cost of a hot water power washer and/or steam cleaner will need to be made. Most of the equipment (nets, brooms, brushes, scrub pads, bucket and tubs, hand sprayers, net handles) will only be replaced as needed.

Chemicals

Virkon® Aquatic, Sani-Foam, iodine, and bleach will have a significant additional cost due to the amount being used at Lost Valley.

Health Testing

Once a year viral assessments of hatchery fish will cost $150-$1000, depending on the laboratory and number of cell lines utilized for tests.

Summary

This plan will provide sufficient biosecurity guidelines for Lost Valley Hatchery. The main focus is the prevention of disease outbreaks and the introduction of invasive species. As with all guidelines, there will be acceptable risks associated with implementation. Activities will be assessed on a case by case basis. These guidelines will be followed as closely as possible. The effectiveness of these guidelines will depend on MDC programs, budgetary items, staffing, and the amount of time to accomplish specific guidelines effectively. Some of the important steps that will be implemented to make Lost Valley more bio-secure include: 1) restricting delivery of fish samples to the "pathology lab" through the office hallways rather than through the production room; 2) requesting fish health/mortality/aquatic nuisance species status information before shipments of fish are received from MDC and non-MDC facilities; 3) establishing zebra mussel monitoring sites; 4) annually monitoring fish populations on-site for viruses and; 5) implementing routine equipment disinfection procedures.

The three main concerns for biosecurity at this facility are: (1) statewide pathology lab within hatchery production building with doorway access from lab to production room, (2) introduction of commercially raised fish routinely transported on-site, and (3) importation of fish from public waters.

There is a need to have the pathology lab located at a non-production facility to minimize the risk of infection to production fish due to diseased fish being brought on-site. A spawning/holding facility needs to be available for bringing in broodfish to be spawned and held if needed. This facility would also be able to hold the wild fish that are collected and held year-round for display purposes. Fish for the urban catfish program could also be held at this site prior to delivery. This facility, if built, would greatly minimize the chance of bringing pathogens into the hatchery from fish collected from the wild and from non-MDC facilities.

APPENDIX A. FISH TRANSFER INFORMATION SHEET

Fish Transfer Information Sheet

(Submit via email at least 3 days prior to shipment)

Today's date: _____

Anticipated shipment date: _____

From: ☐ Blind Pony ☐ Chesapeake ☐ Hunnewell ☐ Indian Trail ☐ Lost Valley ☐ Paho ☐ Other:

To: ☐ Blind Pony ☐ Chesapeake ☐ Hunnewell ☐ Indian Trail ☐ Lost Valley ☐ Paho ☐ Other: _____

Species: Age: ☐ Eggs ☐ Fry ☐ Fingerling ☐ Adults

Lot Designation: _____ From Rearing unit: _____

Lot History

Mortality record for last 15 days provided (see page 2)? ☐ Yes ☐ No
Fish will be taken off feed 24 hours prior to shipment? ☐ Yes ☐ No
Fish were last on the following water source: ☐ Spring ☐ Surface ☐ U/V treated ☐ Well water

The following aquatic nuisance species occur in this hatchery's watershed or the site of fish collection:
☐ Zebra mussels ☐ Parasitic copepods ☐ Rusty crayfish ☐ Quagga mussels
☐ New Zealand mud snails ☐ Other: _____

General Health within last 30 days: ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Unknown
(Basis of this classification: ☐ Mortality records ☐ Observation/feed intake ☐ Necropsy: gills, skin, organs)

If fair or poor: what problems were observed or suspected? _____
Any chronic problems?

Therapeutic Used in last 30 days	Yes v	Date Treated	Why treated?	Results or Comments (cured problem; partial, little or no improvement)
None	☐			
Aquaflor	☐			
Copper sulfate	☐			
Formalin	☐			
Iodine	☐			
Immersion OTC	☐			
MS-222	☐			
Oxytetracycline	☐			
Perox-Aid	☐			
Potassium permaganate	☐			
Potassium chloride (KCl)	☐			
Romet	☐			
Salt- NaCl	☐			
Vaccine (specify)	☐			
Other (specify)	☐			

Mortality Record Previous 15 days

Date		
Month	Day	Daily Mortalities

APPENDIX B. ZEBRA MUSSEL PREVENTION

ZEBRA MUSSEL PREVENTION

POLICY

The Missouri Department of Conservation will work to prevent the spread of zebra mussels from infested waters to uninfested waters.

est. 10/05

PROCEDURES

● RESOURCE THREAT

Zebra mussels can clog power plants, industrial and public drinking water intakes, foul boat hulls, decimate populations of freshwater mussels and other native aquatic organisms, impact fisheries and disrupt aquatic ecosystem functions. Economic impacts of zebra mussels in North America are estimated to be in the billions of dollars.

Because of the ease with which microscopic larval zebra mussels may be transported by the public, it may take several years to detect an infestation. Avoiding known infested areas, or staging equipment use such that waters known, or suspected to be infested, are visited last, will help prevent the spread of zebra mussels. However, boats, equipment, and gear must be decontaminated prior to use in different waters. Personnel will take reasonable precautions to avoid exposure of equipment, facilities, and other waters to zebra mussels.

● PUBLIC OUTREACH AND EDUCATION

Increased public outreach and education will enhance understanding of the potential problems associated with zebra mussels and the measures that may help deter their expansion. Signs should be posted at all MDC owned and managed boat ramps highlighting the potential problems associated with zebra mussels. Information should be distributed through our state, federal and non-governmental agency partners, MDC managed waterfowl areas, trapping associates, sport fishing groups, marinas, lake associations, Department offices and Nature Centers, media outlets and to other water users in Missouri.

● EQUIPMENT DECONTAMINATION PROCEDURES

Appropriate safeguards to prevent the transfer of zebra mussels from one waterbody to another are mandatory and include inspection, treatment, and, if possible, avoidance. The following steps detail equipment decontamination procedures:

1. Thoroughly inspect boats (hulls, drive units, trim plates, transducers), trailers and components (rollers, bunk boards, axles, etc.), equipment (i.e., water pumps, hatchery equipment, siphons, nets, ropes, traps, etc.), and machinery (tractors,

bulldozers, etc.) for adult zebra mussels. Pay close attention to nooks, crannies and other inconspicuous places (i.e., around the motor housing, trim tabs, and water intake screens, or pump fittings). All trash, mud, vegetation, and suspected zebra mussels should be removed and properly disposed of in the trash. Immediately report suspected occurrences of zebra mussels to the Invasive Species Coordinator.

Carpeted bunks and runners on existing boat trailers should be replaced with poly, plastic or wooden bunks as soon as practical; boat trailers regularly moved between known zebra mussel infested waters and other waters should have carpeted bunks and runners replaced immediately. As available, future boat trailers should be purchased with poly/plastic/wooden bunks.

2. All water should be drained from boats, trailers, motors, live wells, bilges, transom wells, holding tanks and live wells, water pumps, pipes, and other equipment prior to leaving a waterway. Pay particular attention to boat hulls under installed decking. Drain as much water as possible from equipment such as lower motor units and portable pumps.

3. Any boat, trailer, tank, equipment, machinery, gear, or net transferred from one body of water into a different body of water or from known infested waters to potentially infested waters must be decontaminated using one of the treatments in Table 1 prior to being used in a new body of water. Equipment decontamination procedures should be completed when moving equipment from infested areas of a water body to uninfested areas of the same water body.

   If boats, nets, and other equipment are only used in one body of water, cleaning between uses is not necessary, but these boats, nets, and other equipment MUST be clearly labeled for use in that body of water ONLY. Periodic cleaning and decontamination (i.e., during winterization or other maintenance) should be conducted to prevent costly repairs. If management or research activities require this equipment to be moved in the future, decontamination procedures will be implemented.

● HATCHERY PRECAUTIONS

Best management practices should be used to protect equipment and facilities and to reduce the opportunity for the spread of zebra mussels to uninfested areas. Introductions of zebra mussels into MDC fish hatcheries or water supply sources would have devastating impacts upon hatchery infrastructure. If infested, hatcheries would then be a possible mechanism for transporting the organisms to uninfested waters.
Therefore, the following precautionary measures will be enacted by MDC fish hatcheries:

1. All attempts will be made to secure fish from sources known to be free of zebra mussels (veligers and adults) (see map at http://intranet/Documents/17407.pdf)

2. All fish and eggs exposed to surface water coming into or leaving any of MDC's hatcheries or other facilities and any fish procured through contract or other means from outside sources must be treated during transportation using one of the

treatments in Table 3. The only exception will be for fish that are stocked into the same water supply that is used by the hatchery (e.g., trout stocked in Bennett Spring branch by Bennett Spring Hatchery staff) and for selected species of conservation concern.

3. Specific limitations may be applied to native mussel and hellbender culture, and other species of conservation concern, on a case-by-case basis.

4. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large scale use of the prescribed treatments listed below. Until these bioassays are conducted, brood stock of these species will only be obtained from waters known to be free of zebra mussels.

Table 1. Zebra Mussel Disinfectants and Usage Guidelines for Boats and Equipment

Disinfectant	Concentration	Contact Time	Usage Guidelines, Safety Precautions, Drawbacks
Vinegar	100%	20 min	Use appropriate personal protective equipment (PPE) and caution. Stay upwind of the spray. Is corrosive to metal and toxic to fish at this concentration, so thoroughly rinse with tap water or water from the next lake or river after disinfection. Ensure that solution does not run-off directly into waterways.
Chlorine	200 ppm	10 min	Use appropriate PPE and caution. Stay upwind of the spray. Is corrosive to metal and rubber and toxic to fish at this concentration, so neutralize with 800 ppm sodium thiosulfate and rinse thoroughly with tap water or water from the next lake or river. Ensure that solution does not run-off directly into waterways.
Power wash with hot water	>104° F	20 min	Use appropriate PPE and caution when using hot water due to possibility of burns/scalding. Temperature and contact times are crucial, as efficiency is weather dependent. Most effective when used in conjunction with air drying (see below). Power wash with hot water, including thoroughly flushing lower motor unit.
Freezing	<32° F	24 hrs	Boats, gear, and equipment should be thoroughly frozen. Ambient air temperature should remain below freezing for the entire contact time. No safety precautions.
Air drying	N/A	3-5 days in hot sun 48 hrs in hot sun	Must dry completely to be effective. Most effective when used in conjunction with hot water (see above). To be used for small nets, gear, pumps, etc., *ONLY AFTER* power washing with hot (104°) water for appropriate contact time.
Salt Bath	1%	24 hrs	Due to the long contact time, may only be used as a bath solution and not sprayed. To be used only for pieces of equipment, gear, and nets that can be completely immersed in the solution.

Table 2. Disinfectant Amounts to Make Needed Concentrations					
Disinfectant	**1 gallon**	**2 gallons**	**5 gallons**	**20 gallons**	**100 gallons**
100% Vinegar	1 gal	2 gal	5 gal	20 gal	100 gal
200 ppm Chlorine (household bleach, 5.25% Chlorine)	0.5 ounce (15 ml)	1.0 ounce (30 ml)	2.5 ounces (75 ml)	11.0 ounces (300 ml)	6 1/3 cups (1.5 L)
200 ppm Chlorine (HTH granular)	0.04 ounce (1.2 g)	0.08 ounce (2.4 g)	0.2 ounce (6 g)	0.8 ounce (24 g)	4.2 ounces (120 g)
800 ppm Sodium Thiosulfate	0.1 ounce (3 g)	0.2 ounce (6 g)	0.5 ounce (15 g)	2.1 ounces (60 g)	10.6 ounces (300 g)
1% Salt Bath (as NaCl)	1/8 cup	1/4 cup	2/3 cup	2 2/3 cups	13 1/3 cups

Notes:

1. Air-drying and hot water are most effective when used in conjunction with each other because their effectiveness is highly dependent upon ambient temperatures and contact times. As needed, hot water wash units should be made available at selected Department facilities.
2. Household bleach (5.25% chlorine) and vinegar can be purchased from grocery or convenience stores. HTH granular chlorine (70% calcium hypochlorite) and Sodium Thiosulfate can be purchased at pool supply stores or chemical companies.
3. All bilges and hidden areas under boat decks must be thoroughly treated as described above.
4. Source: WI DNR (2007) *Equipment Disinfection Protocol for Invasive Species and Viruses*.

Table 3. Hatchery/Fish/Aquatic Organism Zebra Mussel Treatments and Usage Guidelines			
Treatment	**Concentration**	**Contact Time**	**Usage Guidelines/Comments**
NaCl	20,000 ppm	2 hrs	Used for striped bass only. Treatment conducted during transport.
KCl/formalin	750 ppm KCl 25 ppm formalin	1 hr 2 hrs	Used for all other fish species and eggs. Fish and hauling water are pretreated for 1 hour with 750 ppm KCl, followed by a 2-hour treatment with 25-ppm formalin during transport. *DO NOT* treat fish with NaCl to counteract shock, as this decreases the effectiveness of the treatment.

Notes:

1. All fish, including those used in aquaria at nature centers, fairs, etc., are to be treated for zebra mussels while in transit.
2. Treatment concentrations and contact times that are currently exceeded during normal aquaculture operations (e.g., egg hardening and shipping) should be considered effective.
3. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large-scale use of the treatments listed above.
4. For species with known intolerances to recommended zebra mussel treatments, modifications of hatchery assignments, increased use of well water, UV treatment, sand filtration, and other system modifications or treatment/avoidance measures may be needed and should be considered on a case-by-case basis with the involvement and approval of Division Chiefs and the Invasive Species Coordinator.
5. Sources: IA DNR *Fairport Fish Hatchery ANS-HACCP*, Edwards *et al*. 2000.

● INVASIVE SPECIES COORDINATOR ROLE

The MDC Invasive Species Coordinator shall serve as the central point of contact for zebra mussel distribution information, prevention, and control. The coordinator shall maintain a Missouri zebra mussel distribution map on the Department Intranet and Internet websites identifying the location of confirmed sightings of zebra mussel adults and veligers in Missouri waters (see http://intranet/Documents/17407.pdf or http://mdc4.mdc.mo.gov/Documents/17409.pdf). Any collections, observations, sightings, etc., of zebra mussel adults or veligers, including instances when organisms have been found attached to equipment, must be immediately reported to the MDC Invasive Species Coordinator.

5/08(est. 10/05)

APPENDIX C. MUSSEL BROODSTOCK COLLECTION HACCP

Facility: MDC Mussel Propagation	Site: Lost Valley
Project Coordinator: Steve McMurray	**Project Description**: Mussel Broodstock Collection
Site Manager: Rich Cook	
Address: 28232 Hatchery Ave Warsaw, MO 65355	
Phone: 660-438-4465	

Project Description **(Who, What, Where, When, How & Why)**
MDC personnel will collect broodstock mussels from various sites within Missouri during the spring and fall and transfer to MDC hatcheries for propagation.

HACCP Step 2 - Potential Hazard Identification
Vertebrates:
Invertebrates: Zebra Mussels
Plants:
Other Biologics:
Others:

HACCP Step 3 - Flow Diagram

Task # 1	Load equipment

Task # 2	Travel to River

Task # 3	Launch boat and travel to collection site

Task # 4	Collect female mussels by wading or snorkeling

Task # 5	Return to ramp

Task # 6	Load equipment

Task # 7	Travel to quarantine site

Task # 8	Introduce to Hatchery

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Load equipment	Invertebrate: Zebra Mussels	No	The equipment should be clean and dry (5 – 7 days) before starting		No
Travel to River	Invertebrate: Zebra Mussels	No	Equipment should be clean and dry		No
Launch boat and travel to collection site	Invertebrate: Zebra Mussels	No	Equipment should be clean and dry		No
Collect female mussels by wading or snorkeling	Invertebrate: Zebra Mussels	Yes	Mussels could be attached to native mussels or in the water	Scrub collected mussels and visually inspect and place in de-chlorinated tap water	Yes
Return to ramp	Invertebrate: Zebra Mussels	No	Still in same water system		No

HACCP Step 4 - Hazard Analysis, Continued					
Load equipment	Invertebrate: Zebra Mussels	Yes	Could be attached to boat or equipment	Decontaminate entire boat and equipment with a 10 % bleach solution or as otherwise described in related policies.	Yes
Travel to quarantine site	Invertebrate: Zebra Mussels	Yes	ZM could be still attached to the broodstock mussels but are too small to be seen with the naked eye	Collected mussels are quarantined in a closed system for 30 days and re-inspected	Yes
Introduce to Hatchery	Invertebrate: Zebra Mussels	No	Animals have cleared quarantine and should be free of zebra mussels		No

HACCP Step 5 - HACCP Plan
Critical Control Point #1: Task # 4: Collect female mussels by wading or snorkeling
Significant Hazards: Invertebrate: Zebra Mussels
Control Measures: Scrub collected mussels and visually inspect and place in de-chlorinated tap water
Limits for Control Measures: Visually inspect and scrub mussels and place in clean water
Monitoring: What? Zebra mussels
Monitoring: How? Visually
Monitoring: Frequency? Continuously
Monitoring: Who? Collecting biologist
Evaluation & Corrective Actions: More scrubbing
Supporting Documentation:
Critical Control Point #2: Task # 6: Load equipment
Significant Hazards: Invertebrate: Zebra Mussels
Control Measures: Decontaminate entire boat and equipment with a 10 % bleach solution or as otherwise described in related policies.
Limits for Control Measures: Disinfect boat, trailer, motor, and equipment with 10 % bleach solution for 10 minutes
Monitoring: What? Ensuring the equipment is completely covered and clean
Monitoring: How? Visual
Monitoring: Frequency? After every use
Monitoring: Who? Staff
Evaluation & Corrective Actions: Pressure wash equipment, allow to dry 5-7 days
Supporting Documentation: Department zebra mussel prevention policy

Critical Control Point #3: Task # 7: Travel to quarantine site
Significant Hazards: Invertebrate: Zebra Mussels
Control Measures: Collected mussels are quarantined in a closed system for 30 days and re-inspected
Limits for Control Measures: 30 day closed recirculation system of collected animals
Monitoring: What? Presence of zebra mussels
Monitoring: How? Visually
Monitoring: Frequency? After 30 days
Monitoring: Who? Assigned hatchery staff
Evaluation & Corrective Actions: If discovered, additional 30 days quarantine
Supporting Documentation:

Facility: MDC Mussel Propagation	**Activity**: Mussel Broodstock Collection
Address: Lost Valley Hatchery	
Signature:	**Date**:

HACCP Checklist:
Mussel broodstock collection

Facility MDC Mussel Propagation
Site Lost Valley
Coordinator Steve McMurray
Manager Rich Cook
Address Lost Valley Hatchery

☐ **Task # 1: Load equipment**

☐ **Task # 2: Travel to River**

☐ **Task # 3: Launch boat and travel to collection site**

☐ **Task # 4: Collect female mussels by wading or snorkeling**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Invertebrate: Zebra Mussels
- ☐ Control measures were implemented
  Control Measures: Scrub collected mussels and visually inspect and place in de-chlorinated tap water
- ☐ Control limits were maintained
  Control Limits: Visually inspect and scrub mussels and place in clean water
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: More scrubbing

☐ **Task # 5: Return to ramp**

☐ **Task # 6: Load equipment**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Invertebrate: Zebra Mussels

- ☐ Control measures were implemented
  Control Measures: Decontaminate entire boat and equipment with a 10 % bleach solution or as otherwise described in related policies.
- ☐ Control limits were maintained
  Control Limits: Disinfect boat, trailer, motor, and equipment with 10 % bleach solution for 10 minutes.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: Pressure wash equipment and allow to dry 5-7 days.

☐ **Task # 7: Travel to quarantine site**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Invertebrate: Zebra Mussels
- ☐ Control measures were implemented
  Control Measures: Collected mussels are quarantined in a closed system for 30 days and re-inspected
- ☐ Control limits were maintained
  Control Limits: 30 day closed recirculation system of collected animals
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: If discovered, additional 30 days quarantine

☐ **Task # 8: Introduce to Hatchery**

APPENDIX D. BROODSTOCK COLLECTION HACCP

Facility: Lost Valley Hatchery/Statewide Facilities	**Site**: Lake of the Ozarks Below Truman Dam and Various Waters Statewide
Project Coordinator: Randy Terrell	**Project Description**: Collect fish from the Lake of the Ozarks and other locations statewide to be used as broodfish
Site Manager: Rich Cook	
Address: 28232 Hatchery Ave. Warsaw, Missouri 65355	
Phone: 660-438-4465	

Project Description **(Who, What, Where, When, How & Why)**
Central Region Fisheries Management and Lost Valley Hatchery staff participates in the collection and transfer of walleye from the tail waters of Truman Dam on the Lake of the Ozarks to Lost Valley Fish Hatchery during March 17 to April 1 annually by methods of electro fishing for the purpose of propagation. Fish (e.g., paddlefish) are collected at other locations statewide using electro fishing or nets and transferred to this and other hatcheries for use as broodstock on an annual basis. An electro fishing boat is used to collect fish with dip nets or fish are netted using a variety of passive gear and are then placed into holding tanks on boats. Adult fish are sampled to select fish ready to spawn. Selected broodfish are loaded onto a hauling truck equipped with live hauling tanks. Fish are transported to Lost Valley Hatchery or other hatchery facilities where fish are netted from the truck and placed in prepared holding tanks for spawning purposes.

HACCP Step 2 - Potential Hazard Identification
Vertebrates:
Invertebrates: Zebra Mussels
Plants:
Other Biologics:
Others:

HACCP Step 3 - Flow Diagram

Task # 1	Load hatchery and collection equip (i.e., boat, nets, tanks)

Task # 2	Fill hauling truck with ambient water

Task # 3	Travel to sample location

Task # 4	Launch boats and travel to site by water

Task # 5	Capture adult fish and place in holding tank on collection boat

Task # 6	Transfer fish to boat by net or hand, load equipment (e.g., nets) and travel back to hauling truck and load fish onto truck

Task # 7	Load boats

Task # 8	Transfer fish by hauling truck to Lost Valley Hatchery or other facility

Task # 9	Unload fish and gear

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Load hatchery and collection equip (i.e. boat, nets, tanks)	Invertebrate: zebra mussels	No	Equipment should be clean and dry (5-7 days)		No
Fill hauling truck with ambient water	Invertebrate: zebra mussels	No	Water has been through UV units		No
Travel to sample location	Invertebrate: zebra mussels	No	Equipment should be clean and dry		No
Launch boats and travel to site by water	Invertebrate: zebra mussels	No	Task is confined to one location		No
Capture adult fish and place in holding tank on collection boat	Invertebrate: zebra mussels	No	Task is confined to one location		No
Transfer fish to boat by net or hand, load equipment (e.g., nets) and travel back to hauling truck and load fish onto truck	Invertebrate: zebra mussels	Yes	Potential zebra mussel veligers being transferred by water, nets and by fish	Water in hauling truck is treated using the three hour zebra mussel treatment protocol: 3 hours Potassium Chloride @ 750 ppm, and final two hours with Formalin 37 % @ 25 ppm	Yes
Load boats	Invertebrate: zebra mussels	Yes	Transfer of veligers in live wells, by nets, boat, boat motor and trailer	Drain bilge pumps, live wells, and lower unit at lake ramp site	No

HACCP Step 4 - Hazard Analysis					
Transfer fish by hauling truck to Lost Valley Hatchery or other facility	Invertebrate: zebra mussels	No	Fish and water have been in zebra mussel treatment for the required three hours		No
Unload fish and gear	Invertebrate: zebra mussels	Yes	Potential contamination of equip	Nets, boats, motors, trailers tanks are power washed and allowed to dry 5-7 days	Yes

HACCP Step 5 - HACCP Plan
Critical Control Point #1: Task # 6: Transfer fish to boat by net or hand, load gear (e.g., nets) and travel back to hauling truck and load fish onto truck
Significant Hazards: Invertebrate: zebra mussels
Control Measures: Water in hauling truck is treated using zebra mussel treatment protocol : 3 hours Potassium Chloride @ 750 ppm, and final two hours with Formalin 37 % @ 25 ppm
Limits for Control Measures: Water and fish should be treated with the zebra mussel treatment for the required three hours
Monitoring: What? Water in the hauling tanks
Monitoring: How? Visual inspection
Monitoring: Frequency? Once before addition of fish to the tank
Monitoring: Who? Hatchery staff
Evaluation & Corrective Actions: None
Supporting Documentation: Reference related HACCPs and MDC policy.
Critical Control Point #2: Task # 9: Unload fish and gear
Significant Hazards: Invertebrate: zebra mussels
Control Measures: Nets, boats, motors, trailers tanks are power washed and allowed to dry 5-7 days
Limits for Control Measures: Clean equipment with a high pressure wash and allow to dry for 5-7 days
Monitoring: What? Equipment is monitored for presence of standing water.
Monitoring: How? Visual inspection
Monitoring: Frequency? Once before equipment is used again
Monitoring: Who? Hatchery staff
Evaluation & Corrective Actions:

Tag equipment as unclean and require wash and drying before using again	
Supporting Documentation: Reference related HACCPs and MDC policy.	
Facility: Lost Valley Hatchery/Statewide Facilities	**Activity**: Collect fish from the Lake of the Ozarks and other locations statewide to be used as broodfish
Address: 28232 Hatchery Ave. Warsaw, Missouri 65355	
Signature:	**Date**:

HACCP Checklist:
Collect fish from the Lake of the Ozarks and other locations statewide to be used as broodfish.

Facility Lost Valley Hatchery/Statewide Facilities

Site Lake of the Ozarks Below Truman Dam and Various Waters Statewide

Coordinator Randy Terrell

Manager Rich Cook

Address 28232 Hatchery Ave., Warsaw, Missouri 65355

- ☐ **Task # 1: Load hatchery and collection equip i.e. boat, nets, tanks**
- ☐ **Task # 2: Fill hauling truck with well water**
- ☐ **Task # 3: Travel to sample location**
- ☐ **Task # 4: Launch boats and travel to site by water**
- ☐ **Task # 5: Capture adult fish and place in holding tank on collection boat**
- ☐ **Task # 6: Transfer fish to boat by net or hand, load equipment (e.g., nets) and travel back to hauling truck and load fish onto truck**
  CRITICAL CONTROL POINT
  - ☐ Hazards were contained
    Hazards: Invertebrate: zebra mussels
  - ☐ Control measures were implemented
    Control Measures: Water in hauling truck is treated using zebra mussel treatment protocol : 3 hours Potassium Chloride @ 750 ppm, and final two hours with Formalin 37 % @ 25 ppm
  - ☐ Control limits were maintained
    Control Limits: Water and fish should be treated with the zebra mussel treatment for the required three hours
  - ☐ Corrective actions were (performed if necessary)
    Corrective Actions: None

- ☐ **Task # 7: Load boats**

- ☐ **Task # 8: Transfer fish by hauling truck to Lost Valley Hatchery or other facility**

- ☐ **Task # 9: Unload fish and gear**
  CRITICAL CONTROL POINT
  - ☐ Hazards were contained
    Hazards: Invertebrate: zebra mussels
  - ☐ Control measures were implemented
    Control Measures: Nets, boats, motors, trailers tanks are power washed and allowed to dry 5-7 days
  - ☐ Control limits were maintained
    Control Limits: Clean equipment with a high pressure wash and allow to dry for 5-7 days
  - ☐ Corrective actions were (performed if necessary)
    Corrective Actions: Tag equipment as unclean and require wash and drying before using again

APPENDIX E. STATEWIDE FISH PATHOLOGY LAB BIOSECURITY PLAN

Fish Pathology Lab
Biosecurity Plan

Introduction

The Missouri Department of Conservation fish pathology lab is located at Lost Valley Fish Hatchery in Warsaw, MO. The laboratory is located in the main office building which also houses the hatchery's fry production area. The lab is 427 square feet in size and consists of two interconnected rooms (Figure 1). One exit leads into an office hallway and one exit opens into the fish production room.
The Aquatic Animal Health Specialist supervises this laboratory space. Fish necropsy, parasite identification and bacterial culture and identifications are the primary activities performed on-site. Fish samples may come to this facility from any of 11 MDC fish hatcheries, public waters (lakes or streams), and private aquaculture facilities or from anglers.
Samples needing viral or histopath analysis may be prepared in the lab but they are shipped to other labs for analysis so there are no live viruses housed on-site.

Purpose

The purpose of this plan will be to outline steps that will help minimize the risk of inadvertently contaminating Lost Valley Hatchery with pathogens or aquatic nuisance species that could be transported to the fish pathology lab. Following are protocols for the receipt of fish samples and laboratory sanitation.

Fish Sample Receipt
Both live and dead fish samples are presented for examination at the lab.

1. The Aquatic Animal Health Specialist shall obtain a utility cart and buckets dedicated for use with laboratory equipment and samples. These items will be clearly labeled for fish lab use. When necessary, the cart will be used to move samples and equipment to and from the lab. After each use, the cart will be sprayed with a disinfectant.

2. All samples, both live and dead fish, will be delivered to the lab via the employee entrance.

3. Buckets and coolers will be returned to the client for removal from the site or placed in the trash for disposal.

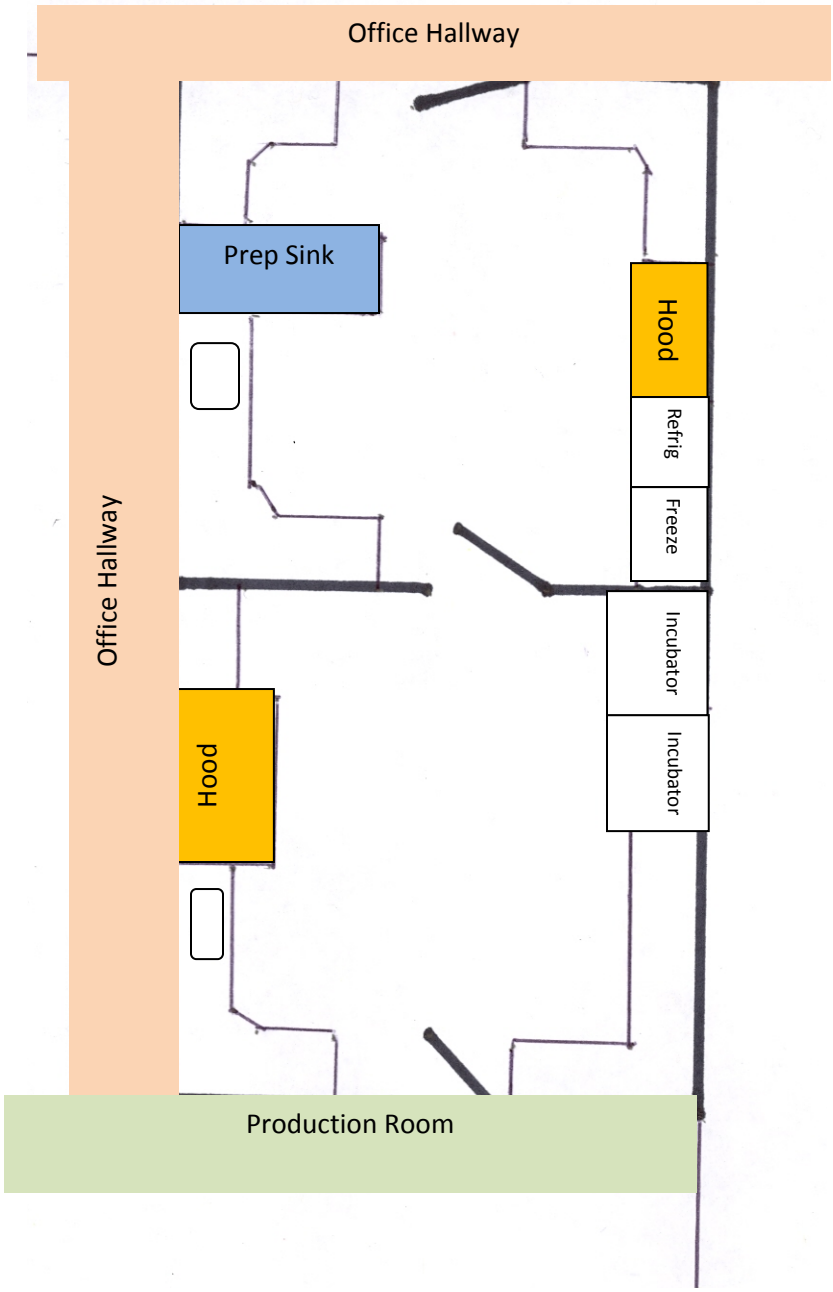

Figure 1. Fish pathology lab layout.

4. Fish originating from Lost Valley Hatchery will be taken to the Hatchery fish lab, from that location, using hatchery equipment, either non-lethal samples will be obtained or the fish will be euthanized and placed on a tray, then carried to the lab. Alternatively, the fish and water will be poured into a "path lab bucket" then carried into the lab. Keeping hatchery buckets out of the path lab will help minimize the risk of transferring a pathogen from the pathology lab to hatchery equipment.

Laboratory Sanitation

1. A foot mat containing 1% Virkon® Aquatic will be placed at the exit from the pathology lab that goes into the fish production room. Traffic through this door will be restricted and for emergency use only. "Through" traffic will be discouraged by signage indicating "authorized personnel only".

2. On days when fish samples or bacterial cultures are analyzed, the lab floors will be mopped with Virkon® Aquatic, 500 ppm bleach, roccal or other laboratory disinfectant.

3. The Aquatic Animal Health Specialist will over-see cleaning of the lab floors and has a mop bucket and mop designated for this use. Maintenance staff will be allowed access to the lab only to empty trash cans.

4. After working with biological samples, counters will be disinfected with Virkon® Aquatic, 500 ppm bleach or roccal. As a general rule, these disinfectants are rotated to provide the broadest spectrum of disinfection.

5. Dead fish will be frozen then placed in the dumpster for disposal off-site.

6. Hazardous materials such as bacterial culture media and bacterial culture loops will be placed in red "hazardous material" bags and autoclaved prior to being disposed of in the dumpster.

7. Sharps such as needles, microscope slides, and scalpel blades will be placed in hard plastic containers, disinfected with 1 part bleach and 9 parts water, soaked overnight, then placed in the dumpster for sanitary disposal.

8. All instruments, pans, and buckets are disinfected and/or autoclaved between uses.

9. Any equipment used "off-site" will be sprayed with a disinfectant before it is brought back to the lab.

Summary

The biosecurity of the fish pathology lab will be maintained by careful disinfection of in-coming and out-going equipment and samples, restricting access to the lab to keep foot traffic through that space to a minimum, and isolating Lost Valley Fish Hatchery equipment from items used in the lab. These measures will minimize risk but will not entirely eliminate it.